eastern half of the city were stripped of fruit buds and foliage, and plants, flowers and vegetables were crushed to the ground.

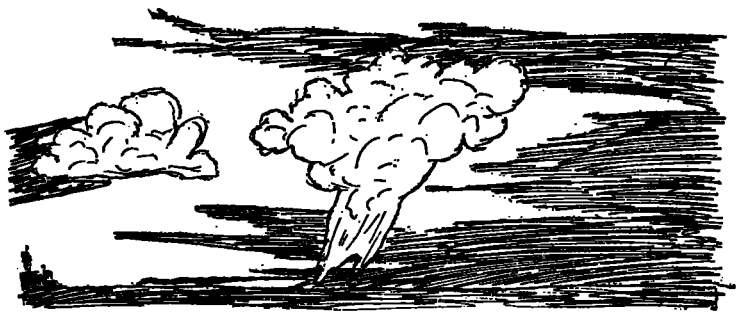
Prof. James A. Merrill, of the Manual Training High School of this city, informed the writer that he found one hailstone showing 11 concentric layers.

The accompanying picture is a copy of a photo made by a Kansas City man of hailstones that fell in the great storm of May 14, 1898. I had a negative made from the old photo, from which this print was made. The hailstones were placed on a brown cloth, the ground being covered with hail, together with two large hen eggs, each showing a small cross in order to show by contrast the size of the hailstones.

[A half-dozen of the principal losses alone totaled over $17,000.]—*P. Connor.*

FUNNEL CLOUD OVER LAKE MICHIGAN, JUNE 29, 1920.

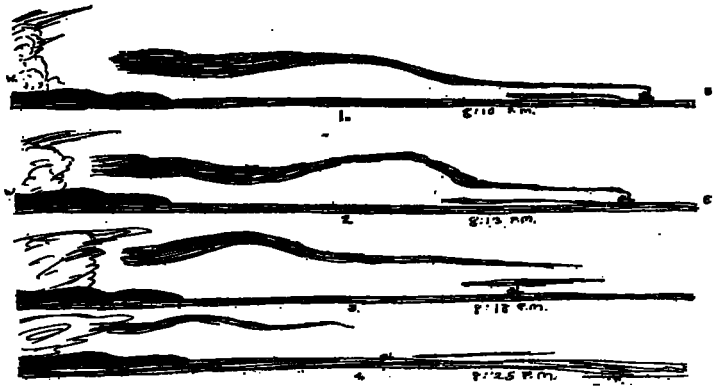
The cloud in the accompanying sketch was seen over Lake Michigan, on looking north from Chicago, at 7:08 p. m. (local summer time), June 29, 1920. The point of the cloud was actually considerably lower than the bulging top, and the drawing shows it as well as I



could represent it. No rotary motion was noticed in connection with the cloud. It changed shape rapidly, and by 7:13 had disappeared. A thundershower of moderate intensity followed within five minutes.—*Allen H. Ward.* This cloud probably marked a vortex which with but little further development would have made a waterspout.—*C. F. B.*

A SMOKE ARCH MARKING AN INCREASE IN WIND.

The sketch, which was made looking north from Chicago on the evening of August 6, 1920, shows a curious curve in a streak of smoke from a small steamer. A thunderstorm was approaching from the west, though it was still some distance away; and the wind was light



(Local Summer Time)

to gentle east to southeast. The curve was first noticed at 8:10 p. m., but became most pronounced three minutes later, with little change in position. By 8:18 it had moved westward considerably. It then began to fade away, and was last seen at 8:25, being then partly over land. At Chicago, the east wind shifted to southeast and increased from light to moderate about 15 minutes after the smoke had disappeared.—*Allen H. Ward.*

SOME FLYING EXPERIENCES IN "BUMPY" WEATHER IN TEXAS.

By D. P. CARLBERK.

[Excerpts from a letter to the Editor, Jan. 20, 1820.]

Entering Barron Field, Everman, Tex., as a cadet I flew there till I was commissioned and thereafter till I was ordered to Post Field in September. Having been both a cadet and an officer through a Texas summer I feel that I am quite familiar with most of the conditions treated in your article.[1]

The "bump" that worried me most was that kind I always thought of as a slender shaft of upcurrent. The big ones lift the whole ship but those wicked little ones kick one wing so sharply and so suddenly, I wondered whether I would ever get to the point where they would not scare me.

After a pilot gets to the place where he is accustomed to the roar of the motor, and the whistling of the wind through the wires, he can hear new sounds, and the contact of those upshoots—the "slender" ones—with the wing surface can actually be heard. It sounds as if someone under your wing had taken a hand full of sand and thrown it up against the wing—kind of a "biff" with a soft hiss to it.

One very hot day I was on a long cross-country flight. Fifteen miles south of Midlothian, Tex., I ran into a mess of "bumps" that were far worse than usual. I sat up and gave attention to the stick when suddenly a big fellow took me in charge—lifted me up about 500 feet and, regardless of my efforts and the power of the "Hispy," swiftly turned the whole ship completely around so that I started back toward the town. The twist seemed to come at the top of the current. I experienced the same twist on two different occasions after that. I could never understand it, unless it so happened by there being two large upcurrents side by side and as their overflows met at the top the twist was created, and that I was caught or tossed to one side, as I reached the top, and there met the twist (between the two "bumps").[2]

The height of "bumpiness" on any particular day does not remain constant. One day I flew for an hour at 5,000 feet. There was not a suggestion of a "bump" above 3,000 feet. When I landed, a pilot, ready to go up, asked me about the air. I had just landed so told him there was perfect air anywhere above 3,000 feet. I happened to be on the line when he came down and he told me that he had gone at once to 5,000 feet and the whole area was covered with "bumps."

Here is a peculiar thing which you doubtless will understand at once but was ever strange to me. It happened a half dozen times at Barron Field.

We always like to fly best in the early morning hours for the air was always good, but if that high, hot, wind—

[1] "Effect of winds and other conditions on the flight of airplanes, MONTHLY WEATHER REVIEW, August, 1919, 47 : 523-532.

[2] Upcurrents are frequently strongly rotational (especially in dust whirls), so only one convectional column would be sufficient to cause Mr. Carlberk's experience.—*C. F. B.*

for which Texas is famous—blew steadily all night, the early flying hours were just as rough as those at noonday. When I first found the rough flying so early in the morning I was much concerned and sought everywhere for a reason. I think an officer told me it was due to the wind blowing all night. I watched it thereafter and found it to be a fact.

I feel that none of the boys have exaggerated when they told you of the great drops and lifts they have gotten from "bumps." While my greatest lift or fall would not exceed 1,500 feet I know of much greater.

DISCUSSION.

The bumpiness of a wind that has blown all night seems to be owing to the turbulence induced in the wind as it goes over the uneven ground. In much of Texas the unevennesses of scattered woods and occasional valleys would be enough to produce the effect observed. The turbulence created in this way gradually reaches to greater and greater heights: thus the wind that has blown all night may be turbulent through a layer of perhaps 1,000 to 3,000 feet.—*C. F. Brooks.*

AERIAL CONDITIONS IN AFRICA.

Some notes on the use of the aeroplane in African exploration by Lieut. L. Walmsley in the *Geographical Journal* for November (vol. liv., No. 5) are valuable in giving the results of experience. Mr. Walmsley points out that "air pockets" are normally encountered during the daytime in tropical Africa up to a height of about 6,000 feet. As a result he had to do his aerial photography in East Africa in the morning and evening, when the light was not favorable. Above 7,000 feet, however, he thinks that operations could be carried out all day long.—*Nature (London), Dec. 11, 1919, p. 379.*

An Airman's Experience in East Africa.—There is much of interest to meteorologists in the articles by Leo Walmsley entitled, "An Airman's Experiences in East Africa," which have appeared in *Blackwood's Magazine* (November and December, 1919).

The author, who served as an aeroplane observer during the war, gives a vivid account of his experiences. The dangers due to the "bumpiness" of the air were frequently serious. In the "most terrific bump of all" "the machine dropped like a stone 200 feet at least, and at such a rate that my field glasses were whipped off my shoulder and were caught in the rigging, two or three yards behind. The pilot's glasses held by the strap on his flying cap, and for two seconds they were suspended in the air above his head." Other adventures included flying through clouds almost into the flank of a mountain and reconnaissance carried out whilst surrounded by thunderstorms on all sides.—*Meteorological Office Circ. 43, Jan. 6, 1920, p. 2.*

Over Egypt and the Sudan.[1]—The desert is the playground of the winds. The wind builds up hills and lays them flat. It blows now hither, now thither. Here it lifts up the sand in great clouds that darken the sun. There it pours down the blessed rain. And the sand drinks up the rain, and laughs. That is how we found the desert in our first two days' flight. * * *

Heavy rain and a bad wind kept us at Heliopolis until 9:18 a. m., February 23. We then got away, intending to make Assuan in the day. Soon after starting we had trouble with the port-engine petrol pump. * * *

We saw little blue sky; and soon the sun was almost completely obscured by mist. About noon a sandstorm was seen away on our port bow, and very menacing it looked. Indeed, neither the desert nor the sky had a smile for us that day. The sandstorm whipped the surface of the desert almost white, the foam of this waterless ocean, and it swept on, an ugly gray-brown cloud that must be hell for anyone in it. Sandstorms are things to be avoided by aeroplanes; they would strip struts and wings and propellers. Rain is bad enough, as we were soon to know. It frayed the cutting edges of our propellers, making many bad patches which had to be repaired and repainted at the first landing.

The rain got worse, and made visibility poor. We were looking for Assiut, and at the very time we were nearly due we were over a place that tallied with it by our map. We landed at 1:15 on the sand close to the houses, and immediately a picturesque crowd of men and boys came running toward us. * * *

On the following morning it was raining, after a curiously warm night. We had slept the sleep of tired dogs in our sleeping bags on the sand of our host's tent. Owing to the delays caused by the weather and the distance of supplies we did not get away from Assiut till 10:45, which meant flying through the hottest hours of the day, and we were very soon to know what the sun can do. The wind, however, was in our favor to the extent of about 18 miles per hour, and we had strong hopes of making Wady Halfa in one flight. We got away in grand style. * * *

The sky rapidly cleared, and before long there was scarcely a cloud to be seen. But that was after a bad patch of rough work for the pilot when the machine, under lumps of heavy clouds, seemed reluctant to keep altitude. There was a time when it looked as if we were in for a return of the previous day's trouble.

Flying at a height of 5,000 and 6,000 feet under these skies, and with 10,000 square miles of desert spread out below, was extraordinarily impressive. But even under a pure blue sky the desert looks terrible. At one part of that day's flight nothing was visible but the desert, although to the expert eye a faint thin line hugging the horizon on one side might have revealed the valley of the river. * * *.—*Aeronautics (London), Mar. 25, 1920, p. 253.*

[1] From an article on "Cairo—Cape Flights: Why they failed," by Maj. C. C. Turner.

SOUTHERLY WINDS AT HIGH ALTITUDES OVER LANSING, MICH., DURING SLEET STORMS OF JANUARY, 1920.

By C. G. ANDRUS.

[Weather Bureau, Lansing, Mich., July 9, 1920.]

In studying Mr. C. LeRoy Meisinger's paper on "The Precipitation of Sleet and the Formation of Glaze in the Eastern United States, January 20 to 25, 1920," which appeared in the February number of the MONTHLY WEATHER REVIEW, 1920, pages 73–80, I found in our local pilot-balloon records two items which Mr. Meisinger did not possess at the time of writing the paper.

The first of these is pertinent to his discussion (p. 76, column 2) of the wind boundary and cloud forming levels above this meridian, and is in the form of a note on the pilot-balloon ascension report at 7 a. m., January 21, 1920. This note refers to the 5/10 alto-stratus cloud covering observed at that time and reads: "White striations of alto-stratus filaments north to south, but moving rapidly from west." This seems to me to be a clear indication that the clouds formed from vapor thrust into the westerly current by another current from the south. I think this was one of the occasions when this cross-hatched effect was very noticeable.